

IN THE CLAIMS

Claims 4-7 have been amended. Claims 8-58 have been added. No claims have been canceled. A listing of claims follows:

1. (Original) A method in a network element comprising:
converting Point to Point Protocol (PPP) protocol data units (PDUs) encapsulated
according to different protocols into PPP PDUs within a uniform
encapsulation; and
transmitting the uniformly encapsulated PPP PDUs.
2. (Original) A method in a network element comprising:
using a Point to Point Protocol over Ethernet (PPPoE) session identifier to track a
first flow of PPP protocol data units (PDUs) encapsulated with a non-
Ethernet protocol;
converting each PDU of the first flow of PPP PDUs into PPPoE PDUs; and
converting each of a flow of PPPoE PDUs with the session identifier into a
second flow of PPP PDUs encapsulated with the non-Ethernet protocol.
3. (Original) A method in a network element comprising:
obtaining a Point to Point Protocol over Ethernet (PPPoE) session identifier for a
first flow of PPP protocol data units (PDUs) that are encapsulated with a
non-Ethernet protocol, wherein the flow of PPP PDUs are received over a
first port;

converting each PPP PDU of the first flow into a flow of PPPoE PDUs;
tracking the converted first flow; and
transmitting the flow of converted PPPoE PDUs via a second port;
converting each of a flow of PPPoE PDUs received via the second port into a
second flow of PPP PDUs of the non-Ethernet protocol, wherein the flow
of PPPoE PDUs received via the second port corresponds to the obtained
PPPoE session identifier.

4. (Currently Amended) A network element comprising:
 - a link layer port to receive link layer traffic encapsulated according to a link layer protocol;
 - a link layer demultiplexer to demultiplex link layer traffic received via the link layer port into Point to Point Protocol over Ethernet (PPPoE) traffic, PPP over non-Ethernet (PPPoX) traffic, and non-PPP traffic;
 - a virtual router coupled with the link layer demultiplexer, to forward non-PPP traffic received from the link layer demultiplexer;
 - a Point to Point Protocol (PPP) switch module having,
 - a PPPoX proxy module to convert PPPoX traffic received from the link layer demultiplexer into PPPoE traffic and to convert PPPoE traffic received from a PPPoE multiplexer/demultiplexer into PPPoX traffic;

a PPPoE switch module to switch PPPoE traffic received from the link layer demultiplexer and from the PPPoE multiplexer/demultiplexer; and
a ~~the~~ PPPoE multiplexer/demultiplexer coupled with the PPPoX proxy module and the PPPoE switch module, the PPPoE multiplexer/demultiplexer to multiplex PPPoE traffic received from the PPPoE switch module and the PPPoX proxy module and to demultiplex PPPoE traffic into different traffic flows according to their session identifier.

5. (Currently Amended) A network comprising:

a first network element

~~receiving to receive~~ a set of one or more flows of Point to Point Protocol over non-Ethernet (PPPoX) traffic via a first port,
~~obtaining to obtain~~ a Point to Point Protocol over Ethernet (PPPoE) session identifier for each of the set of flows of PPPoX traffic,
~~converting to convert~~ each of the set of flows of PPPoX traffic into different flows of PPPoE traffic in accordance with their session identifiers,
~~multiplexing to multiplex~~ the different flows of PPPoE traffic,
~~transmitting to transmit~~ the multiplexed PPPoE traffic via a second port;
and

a second network element coupled with the first network element, the second network element ~~receiving to receive~~ the multiplexed PPPoE traffic and ~~to terminating to terminate~~ each of the different flows of PPPoE traffic.

6. (Currently Amended) A network comprising:

a set of one or more service provider points of presence (PoPs) ~~receiving to~~ receive traffic that includes Point to Point Protocol over non-Ethernet traffic on a set of one or more subscriber side flows and ~~tunneling to~~ tunnel the traffic through a network cloud;

a PoP Major of the service provider coupled with the network cloud, the PoP Major ~~receiving to receive~~ the traffic and ~~transmitting to transmit~~ the traffic as PPP over Ethernet traffic along a single relatively inexpensive media; and

an aggregator coupled with the PoP Major, the aggregator ~~processing to process~~ the PPPoE traffic.

7. (Currently Amended) A set of one or more machine-readable medium that provides instructions, which when executed by a set of one or more processors, cause said set of processors to perform operations in a network element comprising:

converting Point to Point Protocol (PPP) protocol data units (PDUs) encapsulated according to different protocols into PPP PDUs with a uniform encapsulation; and
transmitting the uniformly encapsulated PPP PDUs.

8. (New) The method of claim 1, wherein the uniform encapsulation is PPPoE encapsulation.
9. (New) The method of claim 1, wherein the converting is performed by matching an entry in a data structure that provides a PPPoE session identifier for each PPP PDU to be converted.
10. (New) The method of claim 9, wherein the data structure is not created until a proxy module within the network element attempts to create an entry in the data structure.
11. (New) The method of claim 9, wherein the data structure is modified to indicate that a subscriber side flow is active once a PPP session is opened.
12. (New) The method of claim 1, further comprising :
receiving PPP PDUs with the uniform encapsulation at an aggregator side port; and
converting the PPP PDUs with the uniform encapsulation back into PPP PDUs encapsulated according to different protocols.
13. (New) The method as in claim 1, wherein the network element is agnostic of the encapsulation of the PPP PDUs to be converted.

14. (New) The method of claim 2, wherein the converting each PDU is performed by matching an entry in a data structure within the network element having a relationship between the session identifier and the first flow.

15. (New) The method of claim 14, wherein the data structure is not created until a proxy module within the network element attempts to create an entry in the data structure.

16. (New) The method of claim 14, wherein the data structure is modified to indicate that the first flow is active once a PPP session is opened.

17. (New) The method as in claim 2, wherein the network element is agnostic of the encapsulation of the first flow and the converting each PDU is performed using the session identifier.

18. (New) The method of claim 3, wherein the converting each PDU is performed by matching an entry in a data structure within the network element having a relationship between the session identifier and the first flow.

19. (New) The method of claim 18, wherein the data structure is not created until a proxy module within the network element attempts to create an entry in the data structure.

20. (New) The method of claim 18, wherein the data structure is modified to indicate that the first flow is active once a PPP session is opened.

21. (New) The method as in claim 3, wherein the network element is agnostic of the encapsulation of the first flow.
22. (New) The network element of claim 4, wherein the PPPoX proxy module is to convert the PPPoX traffic by matching an entry in a data structure that provides a PPPoE session identifier for the PPPoX traffic to be converted.
23. (New) The network element of claim 22, wherein the data structure is not created until the PPPoX proxy module attempts to create an entry in the data structure.
24. (New) The network element of claim 22, wherein the data structure is modified to indicate that the PPPoX traffic is active once a PPP session is opened.
25. (New) The network element as in claim 4, wherein the network element is agnostic of the encapsulation of the PPPoX traffic received at the link layer port.
26. (New) The network element of claim 5, wherein the first network element is to convert each of the set of flows of PPPoX traffic by matching an entry in a data structure that provides a PPPoE session identifier for each of the set of flows to be converted.
27. (New) The network element of claim 26, wherein the data structure is not created until the first network element attempts to create an entry in the data structure.

28. (New) The network element of claim 26, wherein the data structure is modified to indicate that a subscriber side flow is active once a PPP session is opened.

29. (New) The network element as in claim 5, wherein the first network element is agnostic of the encapsulation of the PPPoX traffic received by the first element.

30. (New) The network of claim 6, wherein the set of one or more service provider PoPs are to convert each packet within the received traffic that is non-Ethernet traffic by matching an entry in a data structure that provides a PPPoE session identifier for each packet to be converted.

31. (New) The network of claim 30, wherein the data structure is not created until the set of one or more service provider PoPs attempt to create an entry in the data structure.

32. (New) The network of claim 30, wherein the data structure is modified to indicate that the set of one or more subscriber side flows is active once a PPP session is opened.

33. The network as in claim 6, wherein the set of one or more service provider PoPs is agnostic of the encapsulation of the traffic received by the set of one or more service provider PoPs.

34. (New) The machine-readable medium of claim 7, wherein the uniform encapsulation is PPPoE encapsulation.
35. (New) The machine-readable medium of claim 7, wherein the converting is performed by matching an entry in a data structure that provides a PPPoE session identifier for each PPP PDU to be converted.
36. (New) The machine-readable medium of claim 35, wherein the data structure is not created until a proxy module within the network element attempts to create an entry in the data structure.
37. (New) The machine-readable medium of claim 35, wherein the data structure is modified to indicate that a subscriber side flow is active once a PPP session is opened.
38. (New) The machine-readable medium of claim 7 that provides instructions, which when executed by a set of one or more processors, cause said set of processors to perform operations further comprising :
- receiving PPP PDUs with the uniform encapsulation at an aggregator side port;
 - and
 - converting the PPP PDUs with the uniform encapsulation back into PPP PDUs encapsulated according to different protocols.

39 (New) The machine-readable medium of claim 7, wherein the network element is agnostic of the encapsulation of the PPP PDUs to be converted.

40. (New) A method in a network element, comprising:

receiving a first data packet that is not in a format of an output media to the network from a subscriber that accesses the network through the network element;

converting the first data packet into the format of the output media based on a session identifier;

receiving a second data packet encapsulated in the format of the output media;

and

sending the first data packet and the second data packet in the format of the output media.

41. (New) The method as in claim 40, wherein the output media is an Ethernet transmission line.

42. (New) The method as in claim 40, wherein the network element is agnostic of the encapsulation of the first data packet.

43. (New) The method of claim 40, wherein the format of the output media is PPPoE encapsulation.

44. (New) The method of claim 40, wherein the converting of the first data packet is performed by matching an entry in a data structure within the network element having a relationship between the session identifier and the first data packet.

45. (New) The method of claim 44, wherein the data structure is not created until a proxy module within the network element attempts to create an entry in the data structure.

46. (New) The method of claim 44, wherein the data structure is modified to indicate that a subscriber side flow that includes the first data packet is active once a PPP session is opened.

47. (New) The method of claim 40, further comprising :

receiving a third data packet with the session identifier in a format of the output media at an aggregator side port; and

converting the third data packet back into the format of the first data packet based on the session identifier.

48. (New) A method for enabling transmission of PPP packets over a single media in a network element, comprising:

receiving a plurality of data packets;

converting the plurality of data packets into PPPoE data packets by matching an entry in a data structure that provides a PPoE session identifier for each one of the plurality of data packets to be converted; and

transmitting the converted plurality of PPPoE data packets over a single media.

49. (New) The method as in claim 48, wherein the single media is an Ethernet transmission line.

50. (New) The method as in claim 48, wherein the receiving a plurality of data packets is agnostic of the encapsulation of the plurality of data packets.

51. (New) The method of claim 48, wherein the data structure is not created until a proxy module within the network element attempts to create an entry in the data structure.

52. (New) The method of claim 48, wherein the data structure is modified to indicate that a subscriber side flow is active once a PPP session is opened.

53. (New) A network element, comprising :

a demux to separate a plurality of packets into IP data packets and PPPoX data packets;

a virtual router to receive the IP data packets;

a PPP switch module to receive PPPoX data packets and to convert the PPPoX data packets into PPPoE data packets based on a session identifier; and

a port to send the converted data packets.

54. (New) The network element of claim 53, wherein the PPP switch module is to convert the PPPoX data packets by matching an entry in a data structure that provides a PPPoE session identifier for each one of the PPPoX data packets to be converted.

55. (New) The network element of claim 54, wherein the data structure is not created until a proxy module within the PPP switch module attempts to create an entry in the data structure.

56. (New) The network element of claim 54, wherein the data structure is modified to indicate that a subscriber side flow is active once a PPP session is opened.

57. (New) The network element of claim 53, wherein the port also receives PPPoE data packets from an aggregator, and wherein the PPP switch module also receives PPPoE data packets from the port and reconverts the PPPoE data packets into PPPoX data packets based on the session identifier for each one of the PPPoE data packets.

58. (New) The network element as in claim 53, wherein the network element is agnostic of the encapsulation of the PPPoX data packets separated by the demux.